INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION

INSTRUMENT DRAWING

ENGINEERING GRAPHICS & TECHNOLOGY PAPER 2 NOVEMBER 2024

MARKS: 200 **TIME: 3 HOURS**

PLEASE PASTE THE BARCODED LABEL HERE

GENERAL INSTRUCTIONS

1. This examination must be answered using **drawing instruments**.
2. **Non-programmable calculators** may be used.
3. **Section A** (compulsory questions) has **two questions - answer BOTH questions 1 & 2.**
4. **Section B** (compulsory questions) has **two questions - answer BOTH questions 3 & 4.**
5. **Section C** (choice questions) has **three questions - answer ONE question from Question 5, Question 6 or Question 7.**
6. Answer **five questions** in total.
7. Print your **examination number** neatly on each page.
8. Draw on the answer sheets provided.
9. Dimensions or detail not given may be **assumed in good proportion.**
10. All the pages, irrespective of whether the question was attempted or not, must be re-stapled in numerical sequence in the top **left-hand corner only.**

NOTE: This question paper consists of **8 pages** including the cover page and 7 questions.

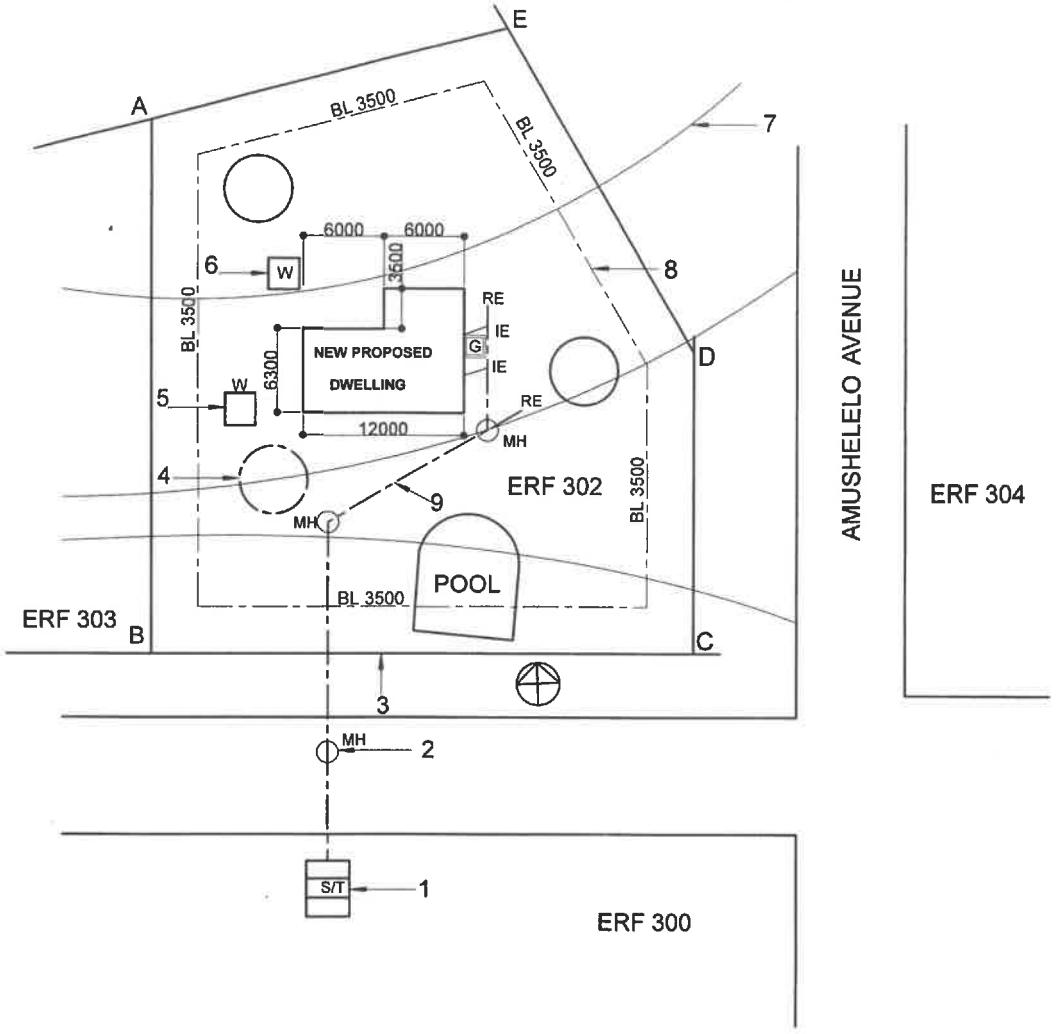
FOR OFFICIAL USE ONLY

	QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
SECTION A Compulsory Questions Answer BOTH questions 1 and 2	1	CIVIL ANALYTICAL			15	
	2	MECHANICAL ANALYTICAL			15	
SECTION B Compulsory Questions Answer BOTH questions 3 and 4	3	CIVIL ASSEMBLY			80	
	4	CIVIL DRAWING			40	
SECTION C Choice questions Answer ONE question from either Question 5,6 or 7 Do not answer all	5	CAM PROFILE			50	
	6	HELIX			50	
	7	CRANK MECHANISM			50	
	TOTAL				200	
	FINAL CONVERTED MARK				100	

EXAMINATION NUMBER

SECTION A	QUESTION 1 15 MARKS
Compulsory Question	CIVIL ANALYTICAL

Note: The drawing (site plan) is not drawn to scale.



Answer the following questions. Write down the correct answer in the space below each question.		
1.1	What does the abbreviation at 1 stand for?	1
	Septic tank	
1.2	What is the feature at 2 called?	1
	Manhole	
1.3	What is the line at 3 called?	1
	Boundary line	
1.4	Why is the feature at 4 drawn with centre line?	1
	Tree/feature to be removed.	
1.5	What is the feature at 5 called?	1
	Water tank	
1.6	What is the feature at 6 called?	1
	Electricity meter	
1.7	Which stand is located south of ERF 302?	1
	ERF 300	
1.8	Why is the location of the septic tank not suitable on the site plan?	1
	Situated on a different property/Against regulations.	
1.9	What is the feature at 7 called?	1
	Contour line	
1.10	What is the line at 8 called?	1
	Building line	
1.11	Why did the municipality reject the location of the pool?	1
	The pool is over the building line	
1.12	What is the line at 9 called?	1
	Sewer line	
1.13	Which elevation of the new proposed dwelling faces Amushelelo Avenue?	1
	East	
1.14	What is the area of the new proposed dwelling in square metres? Write your answer to one decimal place.	2
	96,6m²	
	TOTAL	**15**

1.14 Calculations
(3,5 X 6) + (6,3 X 12)
= 21+75,6
=96,6m²

ANSWER SHEET 1

EXAMINATION NUMBER

SECTION A | QUESTION 2 15 MARKS

Compulsory Question | MECHANICAL ANALYTICAL

Answer the adjacent questions and write down the correct LETTER in the table shown below.

2.1 What does the abbreviation NTS stand for?

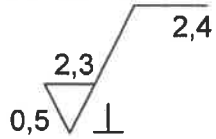
A) Not Thread System

B) Natural True System

C) Not To Scale

D) Not To Standard

2.2 According to the machining symbol, what is the direction of the lay?



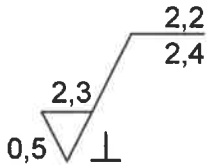
A) Parallel

B) Perpendicular

C) Circular

D) Multi-directional

2.3 According to the machining symbol shown, what is the sample length?



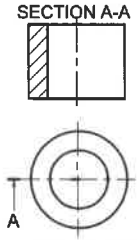
A) 2,2

B) 2,4

C) 2,3

D) 0,5

2.4 What type of section is shown?



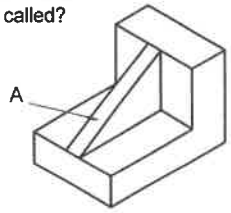
A) Partial Section

B) Quarter Section

C) Half Section

D) Aligned Section

2.5 What is feature A called?



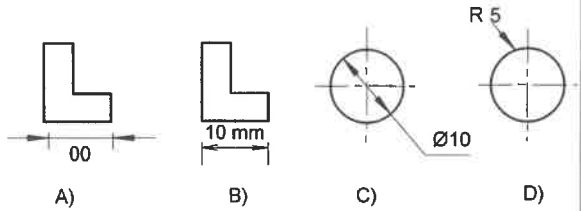
A) Fillet

B) Round

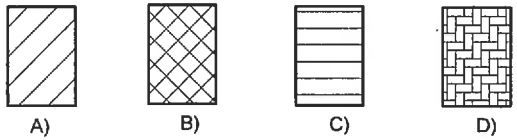
C) Taper

D) Rib

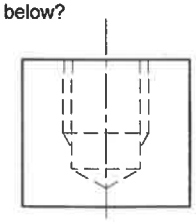
2.6 Which dimensioning style is correct?



2.7 Which of the following components shows diamond knurling?



2.8 What type of hole is shown in the figure below?



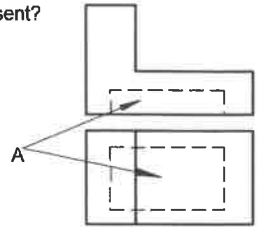
A) Drilled and threaded blind hole

B) Countersunk hole

C) Counterbore hole

D) Threaded through hole

2.9 What feature does A represent?



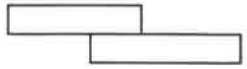
A) Boss

B) Bush

C) Recess

D) Keyway

2.10 What type of welding joint is shown?



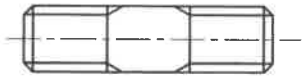
A) Butt joint

B) Edge joint

C) Lapped joint

D) Corner joint

2.11 What is the component called?



A) Feather key

B) Stud

C) M12 Bolt

D) Ø12 Screw

2.12 What does the symbol below represent?

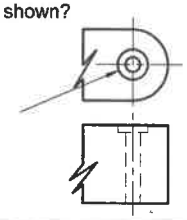
A) The specified roughness must be obtained by machining.

B) The removal of material is not permited.

C) Direction of lay is zero.

D) The roughness value is zero.

2.13 What type of hole is shown?



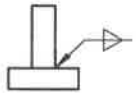
A) Spotface

B) Counterbore

C) Countersunk

D) Threaded hole

2.14 What is the meaning of the symbol shown below?



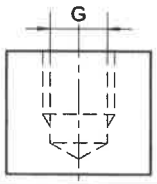
A) Use a fillet weld on site.

B) Weld on both sides.

C) Weld on the other side only.

D) Weld all around.

2.15 If the threaded hole is M14, then what is the exact dimension marked G?



A) 11,2 mm

B) 14 mm

C) 1,4 mm

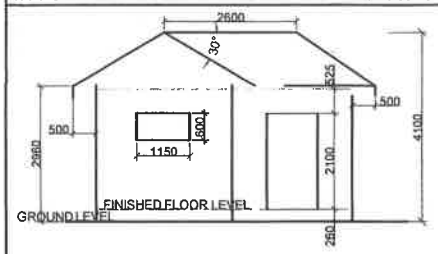
D) 12,6 mm

ANSWER BLOCK		
2.1	2.2	2.3
C	B	B
2.4	2.5	2.6
C	D	C
2.7	2.8	2.9
B	A	C
2.10	2.11	2.12
C	B	B
2.13	2.14	2.15
A	B	A
TOTAL	15	

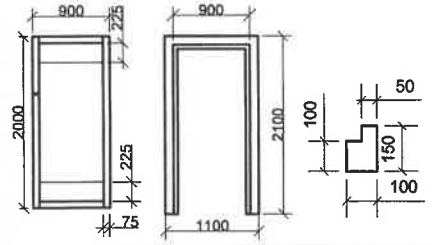
ANSWER SHEET 2

EXAMINATION NUMBER

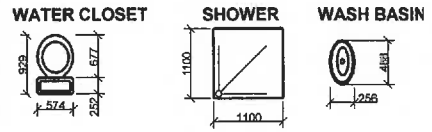
INCOMPLETE FLOOR PLAN AND ELEVATION

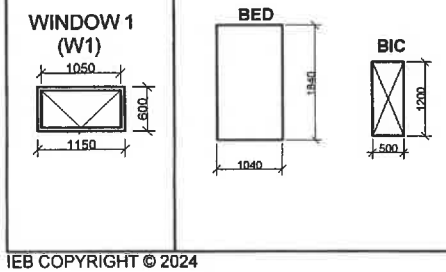


DOOR AND DOOR FRAME DETAIL



PLUMBING FIXTURES





Details of a Security Office are given as follows:

- An incomplete floor plan with walls, window, wash basin, shower, water closet, built-in cupboard and a single bed.
- An incomplete South Elevation with window and door position.
- Door detail, roof detail, window detail, plumbing fixtures, bed, built-in cupboard, notes and north point.

Draw the following:

3.1 The complete floor plan.

3.2 The complete South Elevation.

All drawings and symbols must comply with the SANS 10143, unless stated otherwise.

FLOOR PLAN INSTRUCTIONS

- Draw and hatch all internal and external walls.
- Draw the roof line.
- Draw the missing windows and door.
- Use a scale of 1:50.
- Draw the doorways, as indicated by 4.
- Insert the following electrical detail:
  - A wall mounted light outside the door as indicated by 1.
  - A light in the kitchen and a light in the bedroom, as inicated by 2.
  - A three-pole light switch by the door for the wall-mounted light, the light in the bedroom and the light in the kitchen, as indicated by 3.
  - A light in the bathroom, as indicated by 5.
  - A one-pole light, for the light in the bathroom as indicated by 6.
- The windows do not have window sills.
- Draw the wash basin, shower and water closet.
- Label the Floor plan and the scale.
- Insert the door and door frame.
- Draw the roof line. The wall overhang is 500 mm on all sides, and the wall thickness is 242 mm.
- Draw the bed and built-in cupboard.

SOUTH ELEVATION INSTRUCTIONS

- Draw the complete South Elevation.
- Draw the missing windows and door.
- Label the South Elevation, ground level and finished floor level.
- Draw the 228 x 38 fascia board and the 265 mm wide barge board.
- Draw all roof detail. The roof is covered with corrugated sheeting.

NOTES:

ELECTRICAL FEATURES KEY

1 = Wall mounted light
2 = Ceiling light
3 = Three-pole light switch
5 = Bathroom light
6 = One-pole light switch

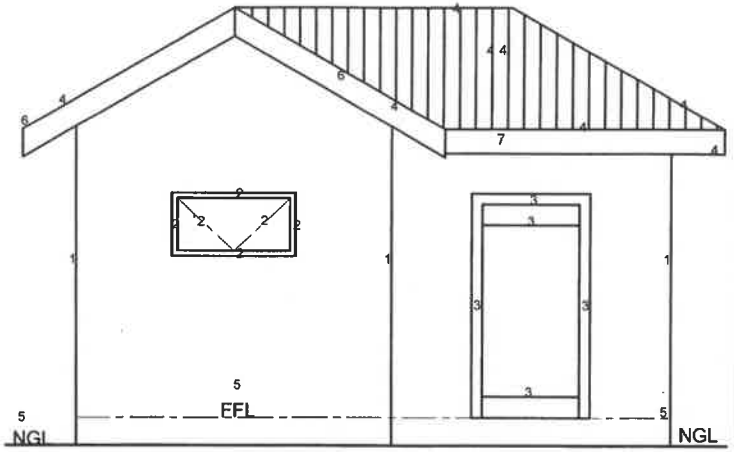
FIXTURES KEY

4 = DOORWAY

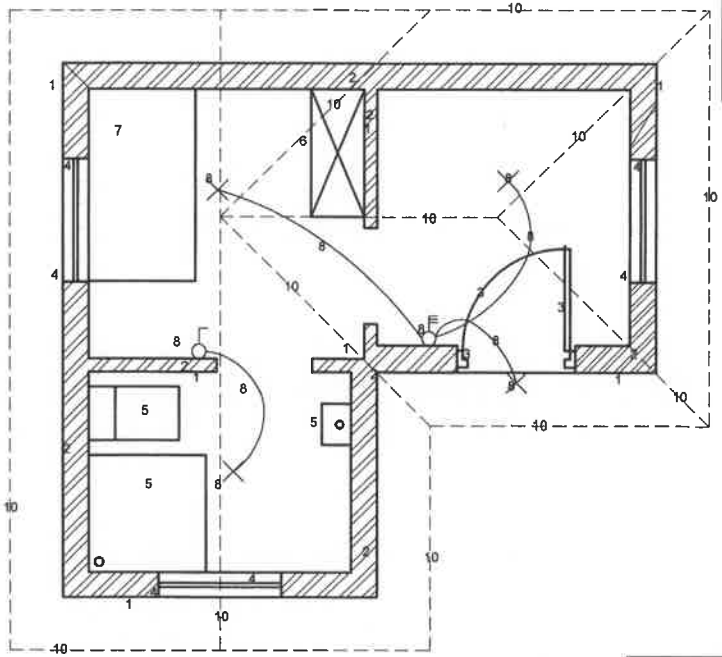
- W1 = Window 1
- SH = Shower
- BIC = Built-in cupboard
- WC = Water closet

SECTION B | **QUESTION 3 80 MARKS**

Compulsory Question | **CIVIL ASSEMBLY**



SOUTH ELEVATION
5



FLOOR PLAN $\frac{1}{2}$
9

SCALE 1:50 $\frac{1}{2}$
9

	ASSESSMENT CRITERIA			
	SOUTH ELEVATION			
1	WALLS			3
2	WINDOW			6
3	DOOR			5
4	ROOF			8
5	LABELS			4
6	BARGE BOARD			2
7	FASCIA BOARD			1
	SUBTOTAL			29
	FLOOR PLAN			
1	WALLS			7
2	HATCHING			7
3	DOOR			3
4	WINDOWS			6
5	PLUMBING			3
6	BIC			1
7	BED			1
8	ELECTRICAL			10
9	LABELS $2x\frac{1}{2}$			1
10	ROOF LINE			12
	SUBTOTAL			51
	TOTAL			**80**

ANSWER SHEET 3

EXAMINATION NUMBER

SECTION B	QUESTION 4 40 MARKS
Compulsory Question	CIVIL DRAWING

Answer this question on ANSWER SHEET 4 (Page 5).

Details for a storeroom are given below:

- A partial floor plan without hatching.
- An incomplete schematic sectional elevation with the floor, window, roof position; ground level, floor level and ceiling level.
- Notes, foundation, floor, window and roof detail.

Draw the following to a scale of 1:20:

- **The complete sectional elevation on cutting plane XX.**
- **Hatch the walls of the partial floor plan.**

All drawings and symbols must comply with the building code of practice, unless stated otherwise.

SECTIONAL ELEVATION INSTRUCTIONS:

- Draw the complete sectional elevation.
- Complete the foundation details.
  - Insert all floor plan and sub-structure details.
  - Use 150 mm compact hardcore filling.
- Label the finished floor level and the SECTIONAL ELEVATION.
- Draw the sectional window using the window detail.
- Draw the roof details:
  - Draw the roof truss using FOUR 114 x 38 rafters and FOUR 90 x 75 truss plates.
  - Use FOUR 75 x 38 purlins spaced at 1080 C/C.
  - Use TWO 121 x 38 wall plates.
  - Use TWO 38 x 38 ceiling battens, spaced appropriately.
  - Use metal sheeting for the roof with a 30° pitch.
  - Use 9 mm gypsum ceiling boards.
- Draw the doorway.
- Show all hatching detail.

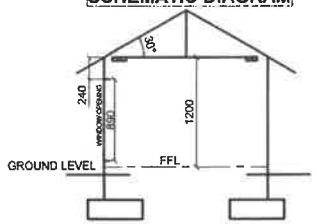
FLOOR PLAN INSTRUCTIONS:

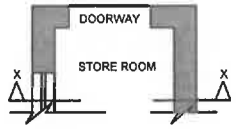
- Hatch the partial floor plan.

NOTES:

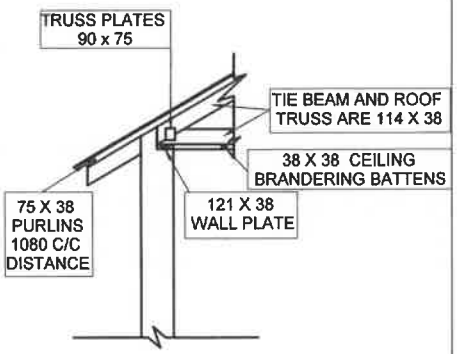
- There is no lintel above the window.
- The window does not have a window sill.
- The roof overhang is 380 mm.
- The truss overhang is 200 mm.
- The top of the slab must be taken as the FFL.

SCHEMATIC DIAGRAM

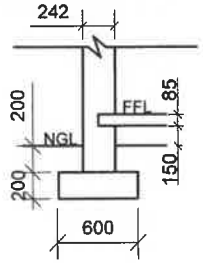




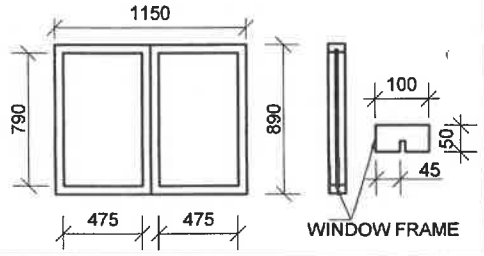
ROOF DETAIL

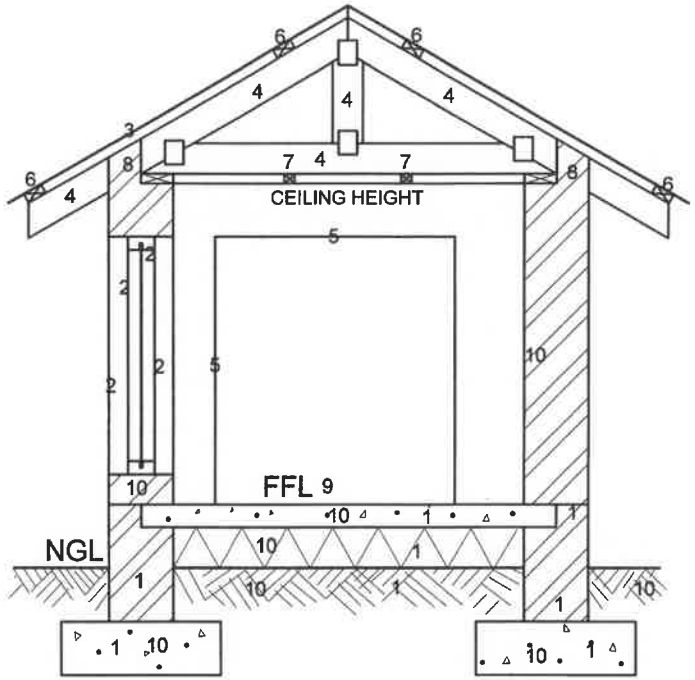


FOUNDATION AND FLOOR DETAIL

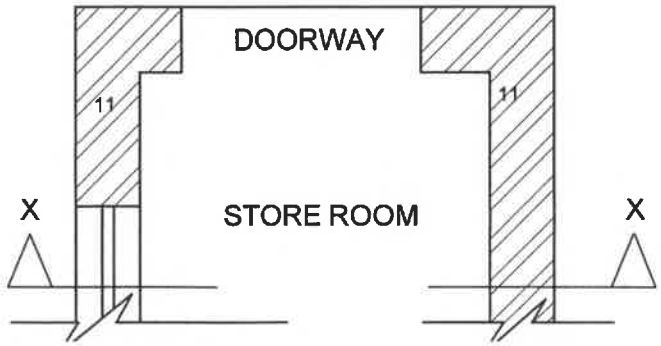


WINDOW DETAIL





SECTIONAL ELEVATION ON X-X 9



	ASSESSMENT CRITERIA			
	SECTONAL ELEVATION			
1	SUBSTRUCTURE			8
2	SECTIONAL WINDOW			4
3	ROOF			1
4	ROOF RAFTERS			5
5	DOORWAY			2
6	PURLINS			4
7	CEILING BATTENS			2
8	WALLS			2
9	LABELS			2
10	HATCHING			8
	SUBTOTAL			38
	FLOOR PLAN			
11	WALL HATCHING			2
	TOTAL			40

ANSWER SHEET 4

EXAMINATION NUMBER

SECTION C	QUESTION 5 50 MARKS
Choice Question	CAM PROFILE

The following details refer to a cam profile. Read the given instructions and answer the questions that follow.

GIVEN:

- The scale of 120 mm = 360°.
- The roller diameter = 12 mm.
- The camshaft diameter = 22 mm.
- The minimum distance from the centre of the camshaft to the profile = 14 mm.
- Direction of rotation is anti-clockwise.
- The details of the camshaft and roller-ended follower.

The cam imparts the following motion to the follower:

- 0°—90° the follower falls 22 mm with uniform motion.
- 90°—180° the follower falls 30 mm with simple harmonic motion.
- 180°—360° the follower returns to the origional position with uniform acceleration and retardation.

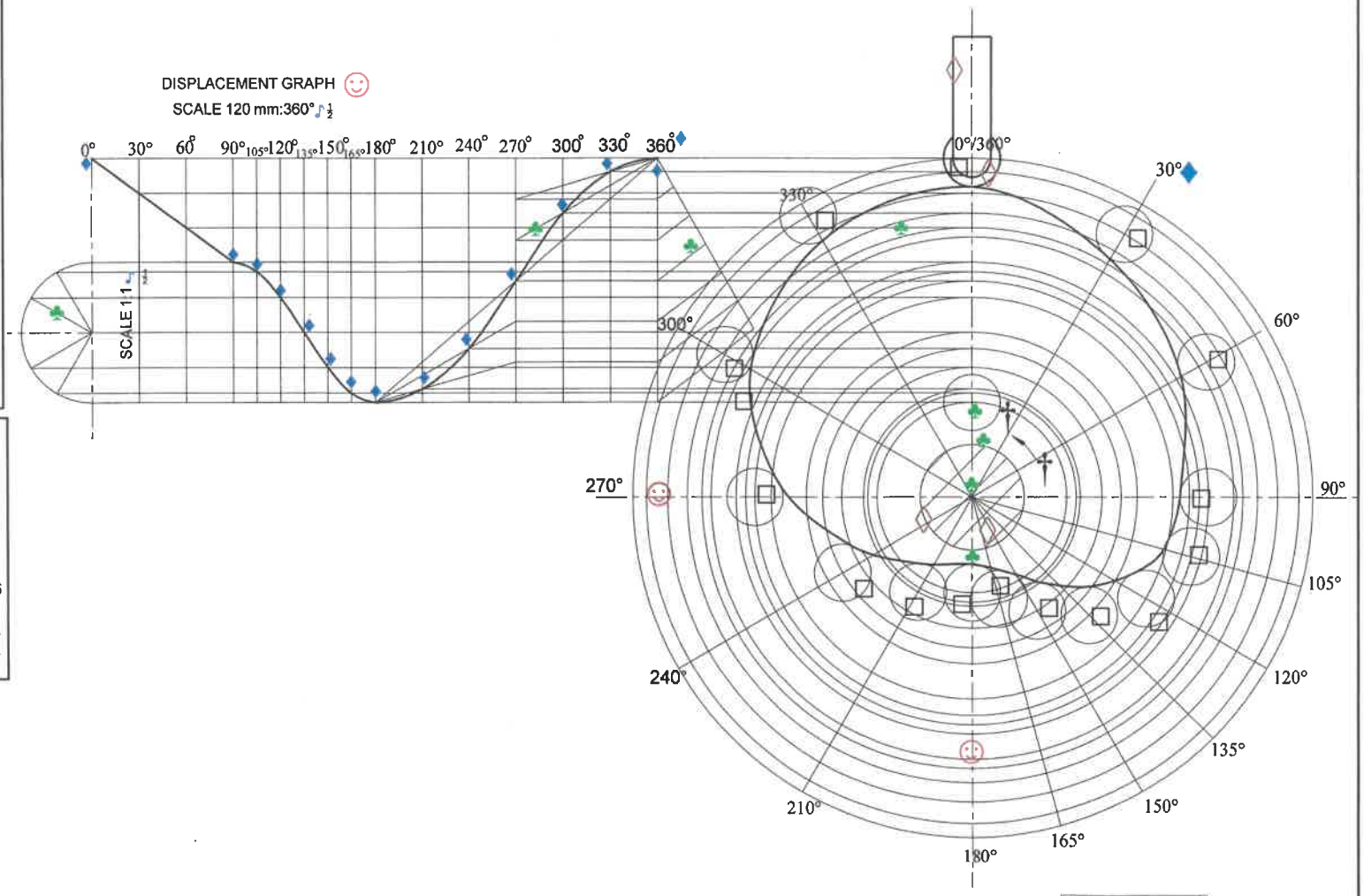
INSTRUCTIONS:

5.1 Draw the camshaft and follower detail and indicate the direction of rotation.
5.2 Draw a displacement graph given a horizontal scale of 120 mm : 360° and a vertical scale of 1:1 for the given motion.
5.3 Label the displacement graph and scale.
5.4 Project and draw the cam profile that would generate the given motion. Show all necessary constructions.
5.5 Label both scales.

ASSESSMENT CRITERIA

You will be assessed on your ability to do the following:

• Draw centre lines + labels	4
• Use the correct min distance	4
• Show constructions	4
• Draw displacement graph	16
• Draw the profile and arrow	16
• Show direction	2
• Draw the follower	2
• Draw the shaft and hatch it	2



ASSESSMENT CRITERIA					
1	Centre lines + label	☺			3
2	Constrs + Min dist	♣			8
3	Disp. Graph + degree symb	♦			16
4	Profile+ Curve	□			16
5	Direction + Arrow	✝			2
6	Follower + Shaft + Hatching	◊			4
7	SCALES 2 x ½	♪			1
	TOTAL				50

ANSWER SHEET 5

EXAMINATION NUMBER

SECTION C	QUESTION 6 50 MARKS
Choice Question	HELIX

GIVEN:

- The front view and side view of an auger (helicoid).

SPECIFICATIONS:

- The direction of rotation is left-handed.
- The core diameter is 40 mm and the outside diameter is 70 mm.
- The auger completes 2 revolutions between A and B.
- The start is point A and the end is point B.

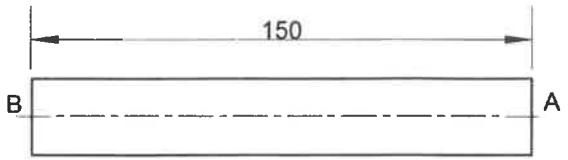
INSTRUCTIONS

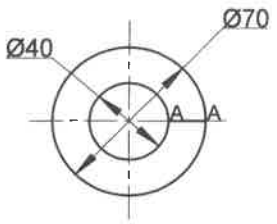
6.1. Complete the given view labelled Figure 6.

6.2. Draw the complete front view of the auger.

6.3. Show all centre lines, constructions and indicate the direction of rotation.

6.4. No hidden detail is required.

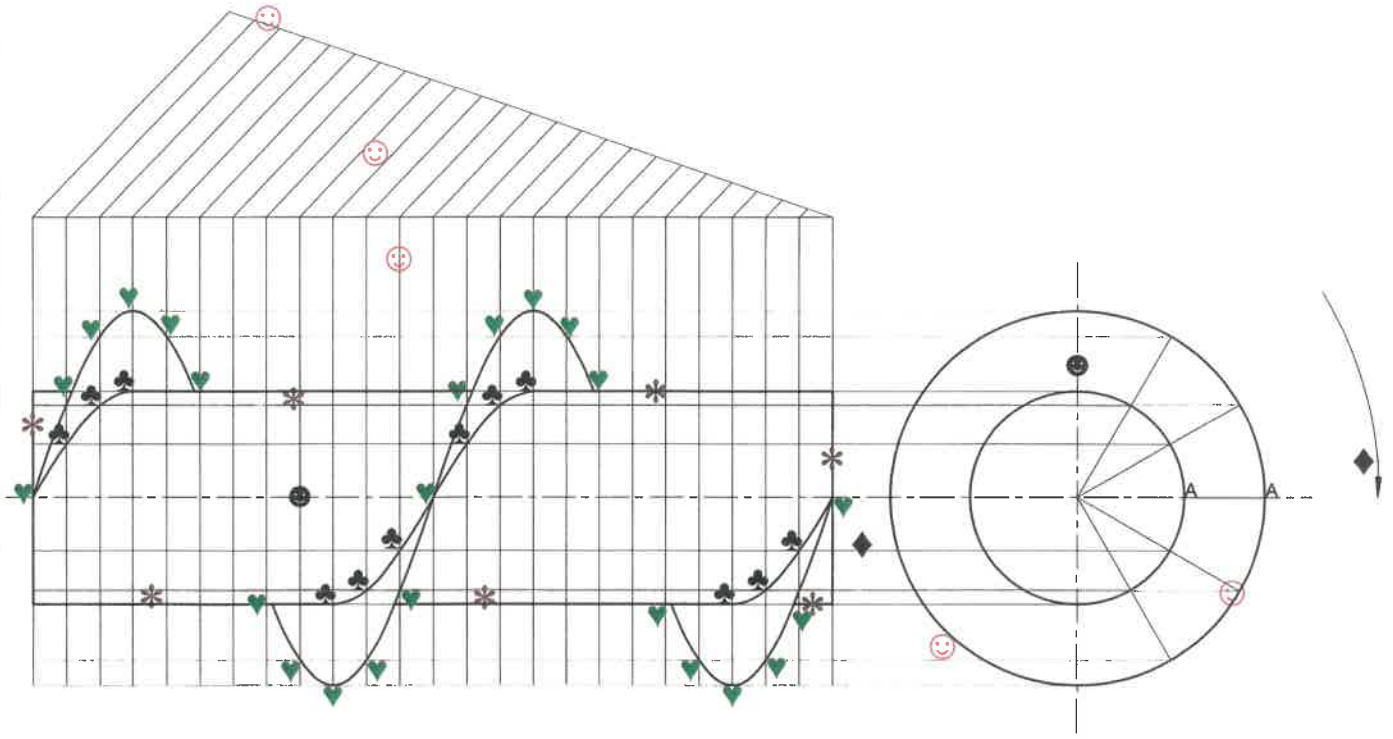




ASSESSMENT CRITERIA

You will be assessed on your ability to do the following:

• Draw the outer locus	23
• Draw the inner locus	12
• Indicate/project the curve according to the given rotation	2
• Draw clear centre lines and the shaft	8
• Show all constructions	5

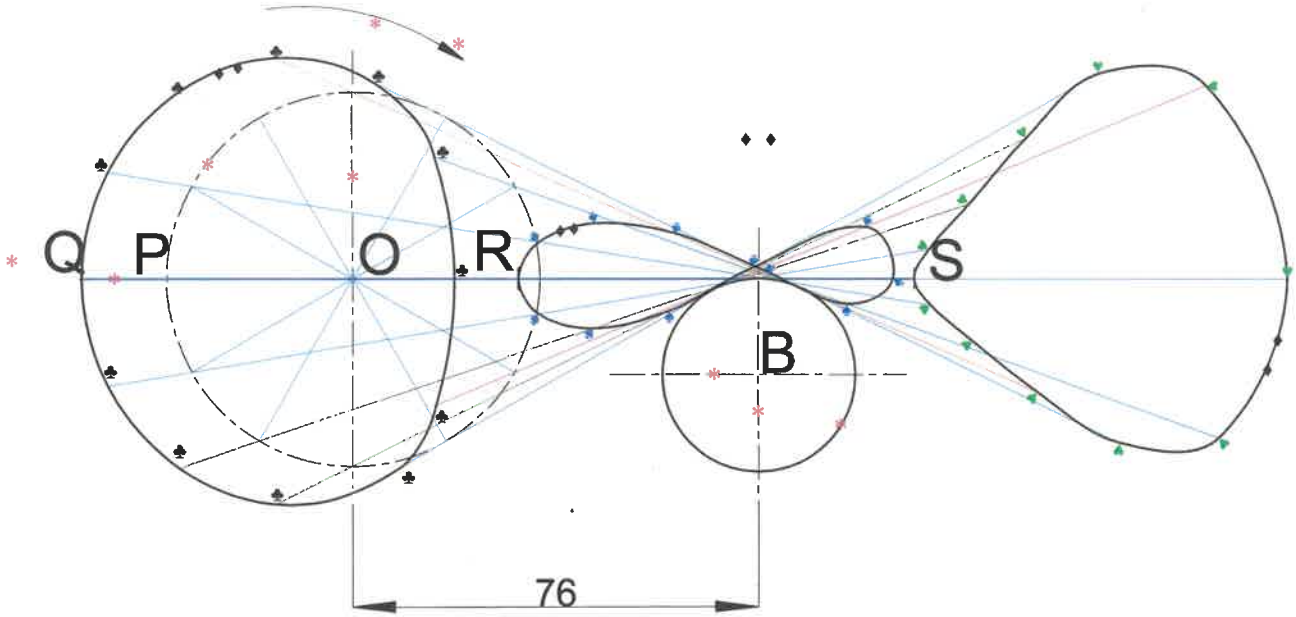


ASSESSMENT CRITERIA				
1	OUTER LOCUS ♥			23
2	INNER LOCUS ♣			12
3	DIRECTION ♦			2
4	SHAFT *			7
5	CONSTRUCTIONS ☺			5
6	CENTRE LINES (0.5X2) ●			1
TOTAL				50

ANSWER SHEET 6

EXAMINATION NUMBER

SECTION C	QUESTION 7 50 MARKS
Choice Question	CRANK MECHANISM



GIVEN:

- A schematic diagram (figure A) shows the graphical representation of the crank mechanism.
  - OP = 35 mm
  - QP = 16 mm
  - PS = 140 mm
  - PR = 66 mm
- The mechanism shown consists of a crank OP.
- Rod PS slides on top of a fixed circle with centre B.
- The crank OP rotates at a constant speed in a clockwise direction for one full revolution.

INSTRUCTIONS

- Draw, full size, the diagram according to the given specifications.
- Trace the loci of points Q, R and S.
- Show all labels, centre lines and constructions.
- Indicate the direction of rotation.

ASSESSMENT CRITERIA

You will be assessed on your ability to do the following:

- Plot the points for the locus of Q 11
- Plot the points for the locus of S 11
- Plot the locus for the locus of R 11
- Draw the given diagram 9
- Draw neat curves and show good line quality 8

ASSESSMENT CRITERIA				
1.	LOCUS Q			11
2.	LOCUS S			11
3.	LOCUS R			11
4.	GIVEN DIAGRAM			9
5	LOCI, LINEWORK + NEATNESS			8
	TOTAL			50

BREAK DOWN OF MARKS	
1. Locus Q	11
2. Locus S	11
3. Locus R	11
Subtotal	33
4. - Line QS	1
- Labels (6)	1
- Arrow / direction	2
- Circle OP	I
- Centre lines	3
- Circle centre B	1
5. - Locus Q	2
- Locus R	2
- Locus S	2
Linework and Neatness	2
Subtotal	17

ANSWER SHEET 7

EXAMINATION NUMBER